I, Toru Nakanishi of 1100-68, Minamiyamada-cho, Kusatsu-shi, Shiga 525-0063 JAPAN, declare under penalty of perjury of the laws of the United States of America, that

1. I am familiar with the Japanese and English languages.

2. I have read the attached translation into English of Japanese Patent Application No. 30501/1996 filed on February 19, 1996 and state that the attached translation is an accurate translation of the Japanese-language original document.

I declare under penalty of perjury under the law of the United States of America that the foregoing is true and correct.

Executed at Otsu-shi, Shiga-ken this 7th day of March, 2001.

Toru Nakanishi

JP Appln. No. 30501/96

[Title of the document] REQUEST FOR GRANT OF PATENT

[Pocket number] 26S00450-A

[Date submitted] February 19, 1996

[Submitted to] The Director General of the Patent Office

[International patent classification] H01L 21/60

[Title of the invention] Adhesive-backed tape for TAB and semiconductor device

[Number of claims] 6

[Inventor]

[Address] c/o Shiga Plant, Toray Industries, Inc. 1-1-1, Sonoyama, Ohtsu-shi, Shiga Pref.

[Name] SAWAMURA, Yasushi

[Inventor]

[Address] c/o Shiga Plant, Toray Industries, Inc. 1-1-1, Sonoyama, Ohtsu-shi, Shiga Pref.

[Name] ANDO, Yoshio

[Inventor]

[Address] c/o Shiga Plant, Toray Industries, Inc. 1-1-1, Sonoyama, Ohtsu-shi, Shiga Pref.

[Name] KONISHI, Yukitsuna

[Applicant]

[Identification number] 000003159

[Postal code] 103

[Address] 2-2-1, Nihonbashi-muromachi, Chuo-ku, Tokyo

[Name] TORAY INDUSTRIES, INC.

[Identification of representative] Representative

[Name of representative] MAEDA, Katsunosuke

[Telephone number] 03-3245-5648

[Payment of fee]

[Payment method] 3: Prepayment

[Prepayment book number] 005186

[Amount of payment] 21,000 yen

[List of documents submitted]

[Title of the document] Specification

[Number of articles] 1

[List of documents submitted]

[Title of the document] Figure

[Number of articles] 1

[List of documents submitted]

[Title of the document] Abstract

[Number of articles] 1

[Necessity of proof] 1: Required

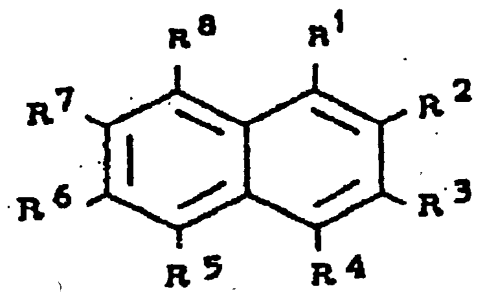
[Title of the document] Specification

[Title of the invention] Adhesive-backed tape for TAB and semiconductor device

[Claims]

[Claim 1] An adhesive-backed tape for TAB, in which a laminate having an adhesive layer and a protective film layer is formed on a flexible organic insulating film, characterized in that the adhesive layer contains a thermoplastic resin (A) and an epoxy resin (B) and that the epoxy resin (B) contains an epoxy resin (b) having a skeletal structure represented by the following general formula (I) as an essential component:

[Chemical formula 1]



...... (I)

(where any two of R1 through R8 denote a 2,3-epoxypropoxy group, and the remaining groups denot a hydrogen atom, lower alkyl group with 1 to 4 carbon atoms or halogen atom).

[Claim 2] An adhesive-backed tape for TAB, according to claim 1, wherein the thermoplastic resin (A) is a polyamide resin (a) containing a dicarboxylic acid with 36 carbon atoms as an essential component.

[Claim 3] An adhesive-backed tape for TAB, according to claim 1 or 2, wherein the thermoplastic resin (A) is a polyamide resin (a) containing a dicarboxylic acid with 36 carbon atoms as an essential component and is a polyamide resin (a') having an amine

value of 1 to less than 3.

[Claim 4] An adhesive-backed tape for TAB, according to claim 1, wherein the adhesive layer further contains a phenol resin (C).

[Claim 5] An adhesive-backed tape for TAB, according to claim 1, wherein the flexible organic insulating film is a film made of a polyimide.

[Claim 6] A semiconductor device, characterized by using the adhesive-backed tape for TAB as set forth in any one of claims 1 through 5.

[Detailed description of the invention]

[0001]

[Technical field of the invention]

This invention relates to an adhesive-backed tape used for the tape automated bonding (TAB) method (hereinafter called "a tape for TAB) that is a semiconductor integrated circuit mounting method. In more detail, it relates to a tape for TAB excellent in insulation performance at high temperature and high humidity, resist removal and adhesiveness after plating.

[0002]

[Prior art]

In general, an adhesive-backed tape for TAB is formed as a three-layer structure, in which an adhesive layer and a protective film layer such as a releasable polyester film are laminated on a flexible organic insulating film such as a polyimide film.

[0003]

The tape for TAB undergoes (1) perforation to form sprocket holes and device holes, (2) thermal lamination with a copper foil, (3) pattern forming (resist coating, etching, resist removal), (4) tin or gold plating, etc., to be processed into a TAB tape (pattern tape). Fig. 1 shows the form of a pattern tape. Fig.

2 is a sectional view showing an embodiment of a semiconductor device. The inner leads 6 of the pattern tape are thermally pressure-bonded to the gold bumps 10 of the semiconductor integrated circuit 8 (inner lead bonding), to mount the semiconductor integrated circuit. Then, the assembly undergoes a resin encapsulation step using an encapsulating resin 9, to prepare a semiconductor device. This semiconductor device is called a tape carrier package (TCP) type semiconductor device. The TCP type semiconductor device is connected, for example, with a circuit board mounted with other parts through outer leads 7 (outer lead bonding), to be mounted on an electronic apparatus.

[0004]

Since the adhesive layer of the tape for TAB finally remains in the package, it is required to have adequate insulation performance, heat resistance and adhesiveness.

[0005]

In recent years, electronic apparatuses are downsized and necessarily densified, and the conductor widths and pitches in the TAB tape method tend to be narrowed. So, the adhesive is required to be higher in insulation performance and adhesiveness. Furthermore, with the narrowing of conductor widths, the chemicals resistance of the adhesive layer exposed to various chemicals in the above-mentioned numerous steps is an important issue as well as the initial adhesive strength. Especially, the chemicals resistance against the alkalis used in resist removal and gold plating and acids used in etching and tin plating is important.

[0006]

The improvement of the adhesive is also variously studied. For example, a method of using a bis A type epoxy resin and a polyamide resin with an amine value of 3 or more (JP, 5-29399, A), a method

of adding an epoxy resin having a siloxane structure (JP, 5-259228, A) and a method of adding a maleimide resin (JP, 5-291356, A) are proposed for the purpose of improving chemicals resistance, and a method of enhancing the purity of an epoxy resin to a chlorine ion content of 200 ppm or less (JP, 7-74213, A) is proposed for the purpose of improving insulation performance.

[0007]

[Problems to be solved by the invention]

However, the adhesives improved by various methods are not sufficient enough to meet the severe demand in the situation of narrowing conductor widths, though they are more or less effective.

[0008]

The object of this invention is to solve these problems by providing a tape for TAB excellent in adhesiveness, chemicals resistance and insulation performance, and a semiconductor device using the same.

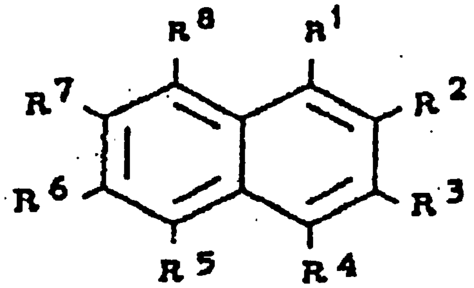
[0009]

[Means for solving the problem]

This invention relates to an adhesive-backed tape for TAB, in which a laminate having an adhesive layer and a protective film layer is formed on a flexible organic insulating film, characterized in that the adhesive layer contains a thermoplastic resin (A) and an epoxy resin (B) and that the epoxy resin (B) contains an epoxy resin (b) having a skeletal structure represented by the following general formula (I) as an essential component:

[0010]

[Chemical formula 2]



...... (I)

(where any two of R1 through R8 denote a 2,3-epoxypropoxy group respectively, and the remaining groups denote, respectively independently, a hydrogen atom, lower alkyl group with 1 to 4 carbon atoms or halogen atom). This invention also relates to a semiconductor device using the same.

[0011]

[Modes for carrying out the invention]

This invention is described below in detail.

[0012]

In this invention, it is important that the adhesive layer contains a thermoplastic resin (A) and an epoxy resin (B) and that the epoxy resin (B) contains an epoxy resin (b) having a skeletal structure represented by the above formula (I) as an essential component.

[0013]

The thermoplastic resin (A) in this invention is not especially limited as far as it makes the adhesive layer flexible. Examples of the thermoplastic resin include polyethylene, polyesters, SBR, NBR, polyamide resins, SEBS, etc. Among them, a polyamide resin (a) containing a dicarboxylic acid with 36 carbon atoms (so-called dimer acid) as a component is preferable since it is low in water absorbability and excellent in insulation

performance. The polyamide resin (a) containing a dimer acid as a component can be obtained by polycondensation of a dimer acid and a diamine according to a conventional method. In this case, a dicarboxylic acid other than a dimer acid such as adipic acid, azelaic acid or sebacic acid can also be contained as a comonomer. As the diamine, a publicly known diamine such as ethylenediamine, hexamethylenediamine or piperazine can be used, and in view of water absorbability and dissolvability, two or more of them can also be used as a mixture. Furthermore, for the purposes of improving the compatibility with the epoxy resin (B) and obtaining good adhesiveness, a polyamide resin (a') leaving the unreactive amine at the polyamide ends obtained by using the diamine more than the equivalent ratio is preferable. The preferable range of the amine value is 1 to less than 3. If the amine value is less than 1, it is difficult to exhibit the effect of improving adhesiveness, and if 3 or more, the storage property of the adhesive per se declines.

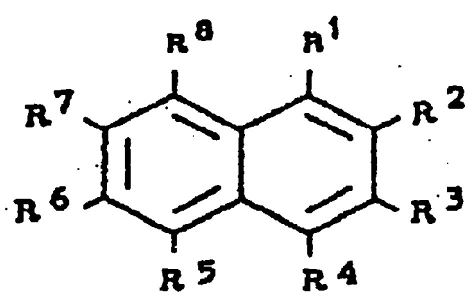
[0014]

The amine value referred to here means the milligrams of KOH equivalent to the perchloric acid used for neutralizing the basic nitrogen contained in 1 g of the polyamide.

[0015]

In this invention, it is important that the epoxy resin (B) contains an epoxy resin (b) having a skeletal structure represented by the following general formula (I) as an essential component

[Chemical formula 3]



...... (I)

(where any two of R1 through R8 denote a 2,3-epoxypropoxy group respectively, and the remaining groups denote, respectively independently, a hydrogen atom, lower alkyl group with 1 to 4 carbon atoms or halogen atom). If the epoxy resin (b) is not contained, high adhesiveness and high insulation performance after resist processing and plating cannot be exhibited.

[0016]

In the above formula (I), preferable examples of R1 through R8 are a hydrogen atom, methyl group, ethyl group, sec-butyl group, t-butyl group, chlorine atom, bromine atom, etc.

[0017]

Preferable examples of the epoxy resin (b) in this invention include 1,5-diglycidylnaphthalene, 1,5-diglycidyl-7-methylnaphthalene, 1,6-diglycidylnaphthalene, 1,6-diglycidyl-2-methylnaphthalene, 1,6-diglycidyl-8-methylnaphthalene, 1,6-diglycidyl-4,8-dimethylnaphthalene, 2-bromo-1,6-diglycidylnaphthalene and 8-bromo-1,6-diglycidylnapthalene.

[0018]

The epoxy resin (B) in this invention can contain an epoxy resin other than the epoxy resin (b), together with the epoxy resin (b). The other epoxy resins that can be used together include, for example, bisphenol A type epoxy resins, bisphenol F type epoxy resins, cresol novolak type epoxy resins, phenol novolak type epoxy resins, various novolak type epoxy resins synthesized from bisphenol A and resorcinol, linear aliphatic epoxy resins, alicyclic epoxy resins, heterocyclic epoxy resins, etc.

[0019]

The content of the epoxy resin (b) contained in the epoxy resin (B) is not especially limited, and as far as the epoxy resin (b) is contained as an essential component, the effects of this invention can be exhibited. However, to exhibit more sufficient effects, the content of the epoxy resin (b) in the epoxy resin (B) must be usually 20 wt% or more. Preferable is 40 wt% or more, and more preferable is 60 wt% or more.

[0020]

The amount of the epoxy resin (B) in this invention is 2 to 100 parts by weight per 100 parts by weight of the polyamide resin. A preferable range is 5 to 70 parts by weight.

[0021]

The flexible insulating film in this invention is a 25 to 125 μm thick film made of a plastic such as a polyimide, polyester, polyphenylene sulfide, polyether sulfone, polyether ether ketone, aramid, polycarbonate or polyarylate or a composite material such as epoxy resin impregnated glass cloth, and a plurality of films of materials selected from the foregoing can also be used as a laminate. Among them, a polyimide film with a small thermal expansion coefficient can be preferably used. It is desirable to treat the surface of any of these films, as required, by means of hydrolysis, corona discharge, low temperature plasma, physical surface roughening or adhesive coating.

[0022]

The protective film layer in this invention is not especially limited if it can be removed from the adhesive surface before a copper foil is laminated, without impairing the form of the tape for TA. For example, a polyester film or polyolefin film that is coated with a silicone or fluorine compound or paper having any of these films laminated can be used.

[0023]

In this invention, if a phenol resin (C) is added to the adhesive layer, adhesiveness and insulation performance can be further enhanced. Examples of the phenol resin (C) include various cresol resins such as phenol novolak resins, cresol novolak resins and bisphenol A type resins.

[0024]

As for the content of the phenol resin, it is usually desirable that the amount of phenolic hydroxyl groups is in a range of 0.5 to 10.0 equivalents for each equivalent of the epoxy resin. A preferable range is 0.7 to 7.0 equivalents.

[0025]

The adhesive layer of this invention can contain a curing accelerator for accelerating the single reaction of the epoxy resin (B) and the reaction between the epoxy resin (B) and the polyamide resin (A) or the phenol resin (C). The curing accelerator is not especially limited if it can accelerate the curing reaction. Examples of the curing accelerator include imidazole compounds such as 2-methylimidazole, 2,4-dimethylimidazole, 2-ethyl-4-methylimidazole, 2-phenylimidazole, 2-phenyl-4-methylimidazole and 2-heptadecylimidazole, tertiary amine compounds such as triethylamine, benzyldimethylamine, α-methylbenzyldimethylamine, 2-(dimethylaminomethyl)phenol, 2,4,6-tris(dimethylaminomethyl)phenol and 1,8-diazabicyclo(5,4.0)undecene-7, organic metal compounds such as zirconium tetramethoxide, zirconium tetrapropoxide, tetrakis(acetylacetonato)zirconium and tri(acetylacetonato)aluminum, and organic phosphine compounds such as triphenylphosphine, trimethylphosphine, triethylphosphine, tributylphosphine,

tri(p-methylphenyl)phosphine and tri(nonylphenyl)phosphine.

[0026]

Two or more of these curing accelerators can also be used together, depending on applications. It is preferable that the amount of the curing accelerator is in a range of 0.1 to 10 parts by weight per 100 parts by weight of the epoxy resin (B).

[0027]

The method for producing an adhesive-backed tape for TAB is described below. A flexible insulating film is coated with a coating material obtained by dissolving an adhesive composition into a solvent, and is dried. It is preferable that the coating material is applied to ensure that the thickness of the adhesive layer becomes 10 to 25 μm. The dry conditions are usually 100 to 200℃ and 1 to 5 minutes. The solvent is not especially limited, but a mixed solvent consisting of an aromatic solvent such as toluene, xylene or chlorobenzene and an alcohol solvent such as methanol, ethanol or propanol is suitable. The film obtained like this is laminated with a protective film, and finally the entire film is usually slit into tapes with a width of about 35 to 158 mm.

[0028]

[Examples]

This invention is described below more particularly in reference to examples.

[0029]

Examples 1 through 3 and Comparative Example 1

The following thermoplastic resins, epoxy resins, phenol resin and additive were mixed at composition ratios shown in Table 1, and the mixtures were dissolved into a mixed solvent consisting of methanol and monochlorobenzene with stirring at 40℃ to obtain adhesive solutions with a concentration of 20 wt% respectively.

[0030]

A. Thermoplastic resins

I. Polyamide resin (acid: dimer acid, amine: hexamethylenediamine, acid value 1.0, amine value 0)

II. Polyamide resin (acid: dimer acid, amine: hexamethylenediamine, acid value 1.0, amine value 2.0)

B. Epoxy resins

I. 1,6-bis(2,3-epoxypropoxy)-naphthalene (epoxy equivalent: 149)

II. Bisphenol A type epoxy resin (epoxy equivalent: 186)

C. Phenol resin

Resol phenol "CKM-1282" (produced by Showa High Polymer Co., Ltd.)

D. Additive

2-heptadecylimidazole

[0031]

These adhesive solutions were applied to a 75 μm thick polyimide film ("Upilex" 75S produced by Ube Industries, Ltd.) using a bar coater, to form a dry thickness of about 18 μm respectively, and dried at 100℃ for 1 minute and at 160℃ for 5 minutes, to prepare adhesive-backed tapes for TAB. Then, an 18 μm thick electrolytic copper foil was laminated on these adhesive-backed tapes for TAB at 140℃ and 9.8 x 10^4 Pa, and the respective laminates were heat-treated in an air oven at 80℃ for 3 hours, at 100℃ for 5 hours and at 150℃ for 5 hours sequentially, to prepare copper-foiled tapes for TAB. On the copper foil surfaces of the obtained copper-foiled tapes for TAB, a photoresist layer was formed, being followed by etching and resist removal according to a conventional method, to prepare samples for evaluating the adhesive strength and tin plating resistance, and the properties of the respective adhesives were evaluated according to the following measuring methods. The results are shown in Table 1.

[0032]

Evaluation method

(1) Tin plating

The sample was immersed in a borofluoric acid based electroless tin plating solution at 70℃ for 5 minutes, to be plated with tin to a thickness of 0.5 μm.

[0033]

(2) Peel strength

From a sample with a conductor width of 50 μm, the conductor was peeled at a speed of 50 mm/min in a 90-degree direction, and the peeling force was measured.

[0034]

(3) High temperature high humidity bias insulation performance

A voltage of 100 V was applied to a comb-shaped pattern for measurement with a conductor width of 200 μm and an inter-conductor distance of 50 μm in an environment of 130℃ and 85% RH, and the time taken till the insulation resistance value declined to 1/10 or less of the initial value was measured.

[0035]

The adhesive-backed tapes for TAB obtained according to the above procedure were used to form conductor circuits for connection with a semiconductor integrated circuit according to the same methods as said evaluation methods (1) and (2), and pattern tapes shown in Fig. 1 were obtained. The physical properties are shown in Table 1.

[0036]

Furthermore, the inner leads of the pattern tapes were bonded at 450℃ for 1 minute for connection with a semiconductor integrated circuit. Then, an epoxy based liquid sealant ("Chip Coat" 1320-617 produced by Hokuriku Toryo K.K.) was used for resin encapsulation,

to obtain semiconductor devices. Fig. 2 shows a section of an obtained semiconductor device.

[0037]

[Table 1]

Item	Example 1	Example 2	Example 3	Comparative Example 1
Epoxy resin (B) I (wt%)	8.0	20.0	20.0	-
Epoxy resin (B) II (wt%)	12.0	-	-	20.0
CKM1282 (C) (wt%)	29.5	29.5	29.5	29.5
Polyamide resin (A) I (wt%)	50.0	50.0	-	50.0
Polyamide resin (A) II (wt%)	-	-	50.0	-
2-heptadecylimidazole (wt%)	0.5	0.5	0.5	0.5
Peel strength Before plating	1.10	1.12	1.19	0.76
Peel strength After plating	0.95	1.09	1.17	0.43
Peel strength holding rate(%)	86.4	97.3	98.3	56.6
High temperature high humidity bias insulation performance(h)	190	>200	>200	85

[0038]

As can be seen from the results of Table 1, the TAB tapes obtained according to this invention have excellent chemicals resistance, high adhesiveness and high moisture insulation resistance. On the other hand, Comparative Example 1 not using the epoxy resin of this invention is low in adhesiveness and also poor in chemicals resistance and moisture insulation resistance.

[0039]

[Effects of the invention]

This invention industrially provides a novel tape for TAB excellent in the insulation performance at high temperature and high humidity, resist removal and adhesiveness after plating, and also a semiconductor device using the same. The tape for TAB of this invention can improve the reliability of the semiconductor devices to be mounted at a high density.

[Brief description of the drawings]

[Fig. 1] A perspective view showing an embodiment of a pattern tape obtained by processing the adhesive-backed tape for TAB of this invention, not yet mounted with a semiconductor integrated

circuit.

[Fig. 2] A sectional view showing an embodiment of a semiconductor device using the adhesive-backed tape for TAB of this invention.

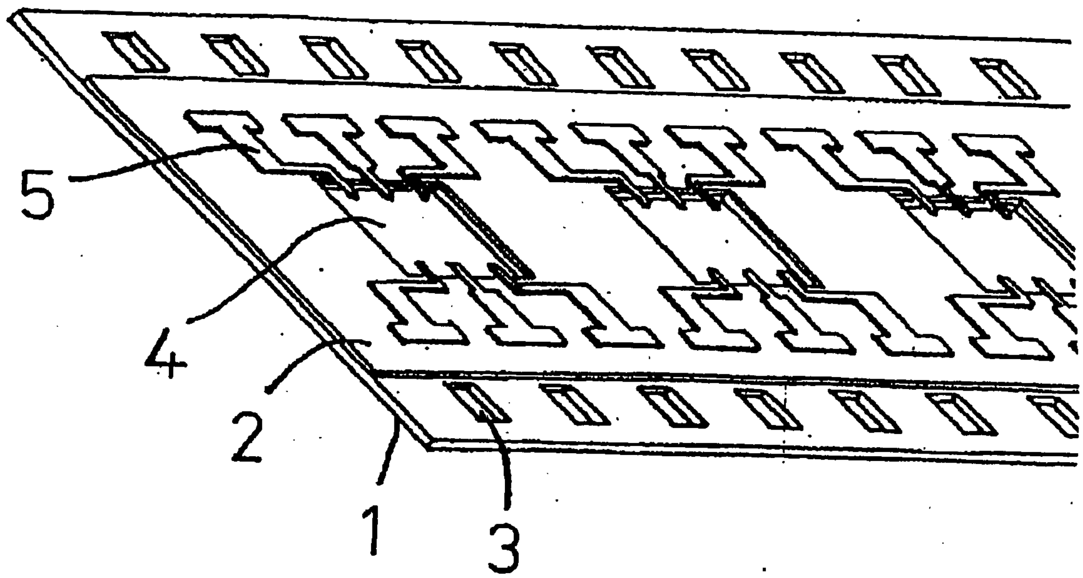
[Meanings of symbols]

1. Flexible insulating film
2. Adhesive
3. Sprocket hole
4. Device hole
5. Conductor for connecting with a semiconductor integrated circuit
6. Inner lead
7. Outer lead
8. Semiconductor integrated circuit
9. Encapsulating resin
10. Gold bump
11. Protective film

[Title of the document] Figure

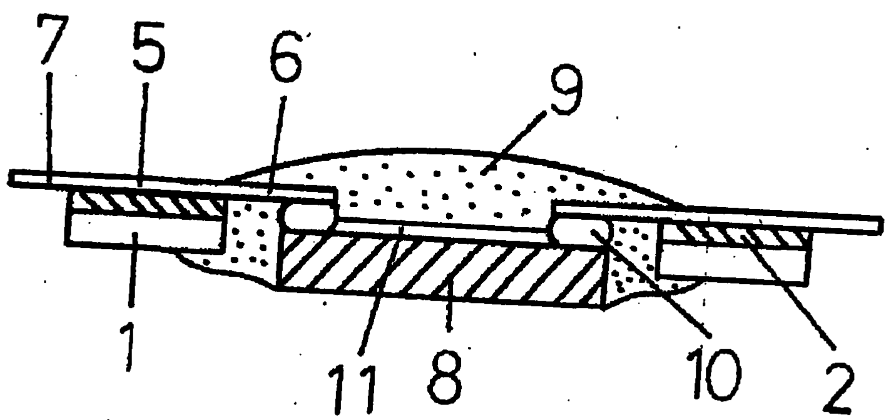
[Fig.1]

Figure 1



[Fig.2]

Figure 2



[Title of the document] Abstract

[Abstract]

[Problem to be solved] To provide a novel tape for TAB excellent in the insulation performance at high temperature and high humidity, resist removal and adhesiveness after plating, and also a semiconductor device using the same, thereby improving the reliability of the semiconductor devices to be mounted at a high density.

[Solution] An adhesive-backed tape for TAB, in which a laminate having an adhesive layer and a protective film layer is formed on a flexible organic insulating film, characterized in that the adhesive layer contains a thermoplastic resin (A) and an epoxy resin (B) and that the epoxy resin (B) contains an epoxy resin (b) having a naphthalene skeletal structure as an essential component.

[Selected drawing] Nil